PHYSICAL CONSTANTS & CONVERSION FACTORS

Named Constants

Atomic mass unit: $1\text{ u} = \frac{1}{12}\text{m}(^{12}\text{C atom}) = 1.66\times10^{-27}\text{ kg} = 931.5\text{ MeV}/c^2$

Avogadro's constant: $N_\text{A} = 6.02\times10^{23}\text{ particles/mole}$

Bohr magneton: $\mu_\text{B} = e\hbar/(2m_\text{e}) = 5.79\times10^{-5}\text{ eV/T} = 9.27\times10^{-24}\text{ J/T(or A}\cdot\text{m}^2\text{)}$

Bohr radius: $a_\text{B} = \hbar^2/(ke^2m_\text{e}) = 5.29\times10^{-11}\text{ m}$

Boltzmann's constant: $k_\text{B} = 8.62\times10^{-5}\text{ eV/K} = 1.38\times10^{-23}\text{ J/K}$

Coulomb force constant: $k = 1/(4\pi\varepsilon_0) = \mu_0c^2/(4\pi) = 8.99\times10^9\text{ N}\cdot\text{m}^2/\text{C}^2$

Electron Compton wavelength: $\lambda_\text{c} = h/(m_\text{e}c) = 2.43\times10^{-12}\text{ m}$

Electron volt: $1\text{ eV} = 1.60\times10^{-19}\text{ J}$

Elementary charge: $e = 1.60\times10^{-19}\text{ C}$

Fine-structure constant: $\alpha = ke^2/(\hbar c) = 7.30\times10^{-3} \approx 1/137$

Gas constant: $R = 8.31\text{ J/(mole}\cdot\text{K)} = 0.0821\text{ liter}\cdot\text{atm/(mole}\cdot\text{K)}$

Gravitational constant: $G = 6.67\times10^{-11}\text{ N}\cdot\text{m}^2/\text{kg}^2$

Mass of electron: $m_\text{e} = 5.49\times10^{-4}\text{ u} = 9.11\times10^{-31}\text{ kg} = 0.511\text{ MeV}/c^2$

Mass of proton: $m_\text{p} = 1.007\text{ u} = 1.673\times10^{-27}\text{ kg} = 938.3\text{ MeV}/c^2$

Mass of neutron: $m_\text{n} = 1.009\text{ u} = 1.675\times10^{-27}\text{ kg} = 939.6\text{ MeV}/c^2$

Nuclear magneton: $\mu_\text{N} = e\hbar/(2m_\text{p}) = 3.15\times10^{-8}\text{ eV/T} = 5.05\times10^{-27}\text{ J/T}$

Permeability of space: $\mu_0 = 4\pi\times10^{-7}\text{ N/A}^2 = 1.26\times10^{-6}\text{ N/A}^2$

Permittivity of space: $\varepsilon_0 = 1/(\mu_0c^2) = 8.85\times10^{-12}\text{ C}^2/(\text{N}\cdot\text{m}^2)$

Planck's constants: $h = 6.63\times10^{-34}\text{ J}\cdot\text{s} = 4.14\times10^{-15}\text{ eV}\cdot\text{s}$

$\hbar = h/2\pi = 1.05\times10^{-34}\text{ J}\cdot\text{s} = 6.58\times10^{-16}\text{ eV}\cdot\text{s}$

Rydberg constant: $R = m_\text{e}k^2e^4/(4\pi c\hbar^3) = 1.10\times10^{-2}\text{ nm}^{-1}$

Rydberg energy: $E_\text{R} = hcR = m_\text{e}k^2e^4/(2\hbar^2) = 13.6\text{ eV}$

Speed of light: $c = 3.00\times10^8\text{ m/s}$

Useful Combinations

$hc = 1240\text{ eV}\cdot\text{nm} = 1240\text{ MeV}\cdot\text{fm}$

$\hbar c = 197\text{ eV}\cdot\text{nm} = 197\text{ MeV}\cdot\text{fm}$

$ke^2 = 1.44\text{ eV}\cdot\text{nm} = 1.44\text{ MeV}\cdot\text{fm}$

$N_\text{A}\times(1\text{ u}) = 1\text{ gram}$

$k_\text{B}T = 0.026\text{ eV}$ at room temperature (300K)

Conversion Factors

Area: 1 barn = 10^{-28} m^2

Energy: 1 cal = 4.184 J
1 eV = 1.60 × 10^{-19} J

Length: 1Å = 1 angstrom = 10^{-10} m
1 ft = 30.48 cm
1 in = 2.54 cm
1 mi = 1609 m

Mass: 1 lb(mass) = 0.454 kg
1 MeV/c^2 = 1.07 × 10^{-3} u = 1.78 × 10^{-30} kg

$1\text{ u} = \frac{1}{12}\text{m}(^{12}\text{C atom}) = 931.5\text{ MeV}/c^2 = 1.66\times10^{-27}\text{ kg}$

Momentum: $1\text{ MeV}/c = 5.34\times10^{-22}\text{ kg}\cdot\text{m/s}$